

IBM System x3650 M4 BD

IBM Redbooks Product Guide

The IBM® System x3650 M4 BD server offers a cost-effective, high-capacity storage solution with exceptional energy-smart design, leadership virtualization, and powerful systems management. It supports up to two Intel Xeon processor E5-2600 v2 family processors and high-density memory designs with 16 DDR3 DIMM slots. This 2U server is built on IBM X-Architecture®, and it consolidates storage and server into one system, offers easy management, and saves floor space and power consumption, costing less money than traditional enterprise offerings.

Suggested use: Big data, email and collaboration applications, databases, virtualization and cloud, virtual desktops, and virtual storage.

The following figure shows the IBM System x3650 M4 BD.



Figure 1. The IBM System x3650 M4 BD

Did you know?

The IBM System x3650 M4 BD server is designed to provide exceptional value and flexibility to meet "big data" requirements and general business and storage-demanding applications, with up to 56 TB of storage space in a dense 2U form factor, Intel Xeon E5-2600 v2 product family processors, two DIMMs per channel running at up to 1866 MHz, and 80 PLUS certified power supplies.

The flexible onboard Ethernet solution provides three integrated Gigabit Ethernet ports, one dedicated systems management port, and an optional embedded 10 GbE ports.

Comprehensive systems management tools with the next-generation Integrated Management Module II (IMM2) make it easy to deploy, integrate, service, and manage.

Key features

Backed by IBM worldwide service and support, the x3650 M4 BD is developed, quality-tested, and certified by IBM, the leading vendor in technology patents for 20 years running. IBM System x® advancements in scalability, reliability, and performance can help your business innovate and thrive. With more flexible configuration options, energy-efficient components, and robust systems management tools, the x3650 M4 BD is an innovative design by IBM that can deliver business value over the long term.

Scalability and performance

The x3650 M4 BD offers numerous features to boost performance, improve scalability, and reduce costs:

- The Intel Xeon processor E5-2600 v2 product family improves productivity by offering superior system performance with up to 12-core processors (up to 2.4 GHz core speeds) or up to 2.8 GHz core speeds (10-core processors), up to 30 MB of L3 cache, and QPI interconnect links of up to 8 GTps.
- Up to two processors, 24 cores, and 48 threads maximize the concurrent running of multithreaded applications.
- Intelligent and adaptive system performance with Intel Turbo Boost Technology 2.0 allows processor cores to run at maximum speeds during peak workloads by temporarily going beyond processor thermal design power (TDP).
- Intel Hyper-Threading Technology boosts performance for multithreaded applications by enabling simultaneous multithreading within each processor core, up to two threads per core.
- Intel Virtualization Technology integrates hardware-level virtualization hooks that allow operating system vendors to better use the hardware for virtualization workloads.
- Intel Advanced Vector Extensions (AVX) improve floating point performance for compute-intensive technical and scientific applications.
- Support for up to 512 GB of memory through 16 DIMM slots with 32 GB LRDIMMs.
- Support for two DIMMs per channel running at 1866 MHz to help maximize system performance.
- The use of solid-state drives (SSDs) instead of, or along with, traditional spinning drives (HDDs) can improve I/O performance. An SSD can support up to 100 times more I/O operations per second (IOPS) than a typical HDD.
- The server offers three integrated Gigabit Ethernet ports, one dedicated 1 GbE management port, and optional embedded 10 GbE ports for flexible network connectivity.
- The server offers PCI Express (PCIe) 3.0 I/O expansion capabilities that improve the theoretical maximum bandwidth by almost 100% (8 GTps per link using 128b/130b encoding) compared to the previous generation of PCI Express 2.0 (5 GTps per link using 8b/10b encoding).
- With Intel Integrated I/O Technology, the PCI Express 3.0 controller is integrated into the Intel Xeon processor E5 family. This controller helps to reduce I/O latency and increase overall system performance.
- Up to fourteen 3.5-inch hot-swap drive bays provide maximum internal storage density of up to 56 TB in a 2U form factor.

Availability and serviceability

The x3650 M4 BD provides many features to simplify serviceability and increase system uptime:

- The server offers Chipkill, memory mirroring, and memory rank sparing for redundancy in the event of a non-correctable memory failure to prevent an unplanned outage.
- Tool-less cover removal provides easy access to upgrades and serviceable parts, such as processor, memory, and adapters.
- The server offers hot-swap drives supporting basic and advanced hardware RAID redundancy for data protection and greater system uptime.
- The server offers up to two redundant hot-swap power supplies and three dual-motor non-hot-swap redundant fans to provide cost-efficient availability for applications.
- The power source-independent light path diagnostics with individual light path LEDs quickly lead the technician to failed (or failing) components, simplifying servicing, speeding up problem resolution, and helping improve system availability.
- Predictive Failure Analysis (PFA) detects when system components (processors, memory, hard disk drives, fans, and power supplies) operate outside of standard thresholds and generates proactive alerts in advance of a possible failure, therefore increasing uptime.
- Solid-state drives (SSDs) offer better reliability than traditional mechanical HDDs for greater uptime.
- The built-in Integrated Management Module II (IMM2) continuously monitors system parameters, triggers alerts, and performs recovery actions in case of failure, to minimize downtime.
- Built-in diagnostic tests using Dynamic Systems Analysis (DSA) Preboot speeds up troubleshooting tasks to reduce service time.
- Three-year customer replaceable unit and onsite limited warranty, next business day 9x5. Optional service upgrades are available.

Manageability and security

Powerful systems management features simplify local and remote management of the x3650 M4 BD:

- The server includes an Integrated Management Module II (IMM2) to monitor server availability and perform remote management.
- An integrated industry-standard Unified Extensible Firmware Interface (UEFI) enables improved setup, configuration, and updates, and simplifies error handling.
- Integrated Trusted Platform Module (TPM) V1.2 support enables advanced cryptographic functions, such as digital signatures and remote attestation.
- IBM Systems Director is included for proactive systems management. It offers comprehensive systems management tools that help increase uptime, reduce costs, and improve productivity through advanced server management capabilities.
- Industry-standard AES NI support provides faster and stronger encryption.
- The Intel Execute Disable Bit function can help prevent certain classes of malicious buffer overflow attacks when combined with a supporting operating system.
- Intel Trusted Execution Technology provides enhanced security through hardware-based resistance to malicious software attacks, allowing an application to run in its own isolated space that is protected from all other software running on a system.

Energy efficiency

The x3650 M4 BD offers the following energy-efficiency features to save energy, reduce operational costs, increase energy availability, and contribute to a green environment:

- Energy-efficient system board components help lower operational costs.
- 80 PLUS certified power supplies enable greater energy savings while providing flexibility to meet your business needs.
- The Intel Xeon processor E5-2600 v2 product family offers better performance over the previous generation, while fitting into the same TDP limits.
- Intel Intelligent Power Capability powers individual processor elements on and off as needed to reduce power draw.
- Low-voltage Intel Xeon processors draw less energy to satisfy the demands of power and thermally constrained data centers and telecommunication environments.
- Low-voltage 1.35 V DDR3 memory RDIMMs consume 19% less energy compared to 1.5 V DDR3 RDIMMs.
- Solid-state drives (SSDs) consume as much as 80% less power than traditional spinning HDDs.
- The server uses hexagonal ventilation holes, a part of IBM Calibrated Vectors Cooling™ technology. Hexagonal holes can be grouped more densely than round holes, providing more efficient airflow through the system.
- IBM Systems Director Active Energy Manager™ provides advanced data center power notification and management to help achieve lower heat output and reduced cooling needs.

Locations of key components and connectors

The following figure shows the front of the server.

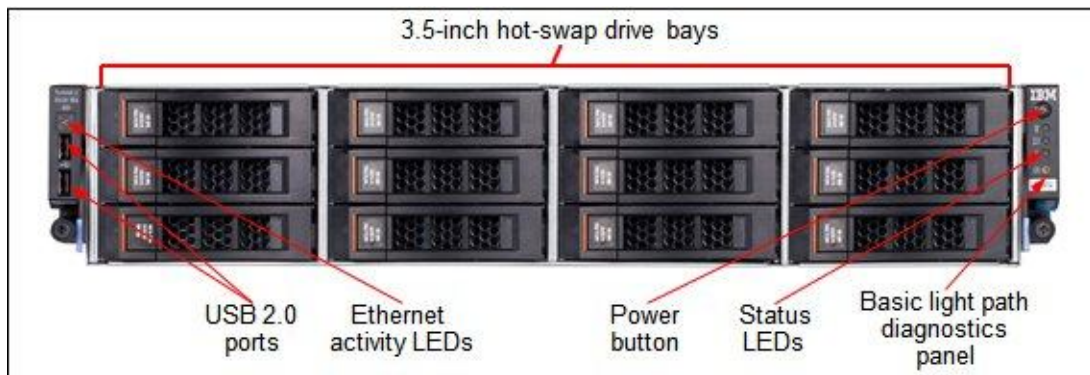


Figure 2. Front view of the IBM System x3650 M4 BD

The following figure shows the rear of the server.

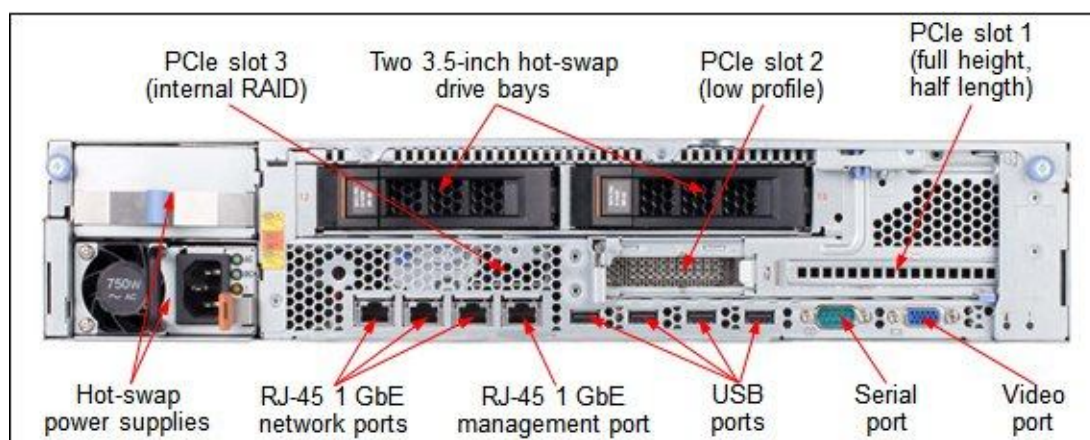


Figure 3. Rear view of the IBM System x3650 M4 BD

The following figure shows the locations of key components inside the server.

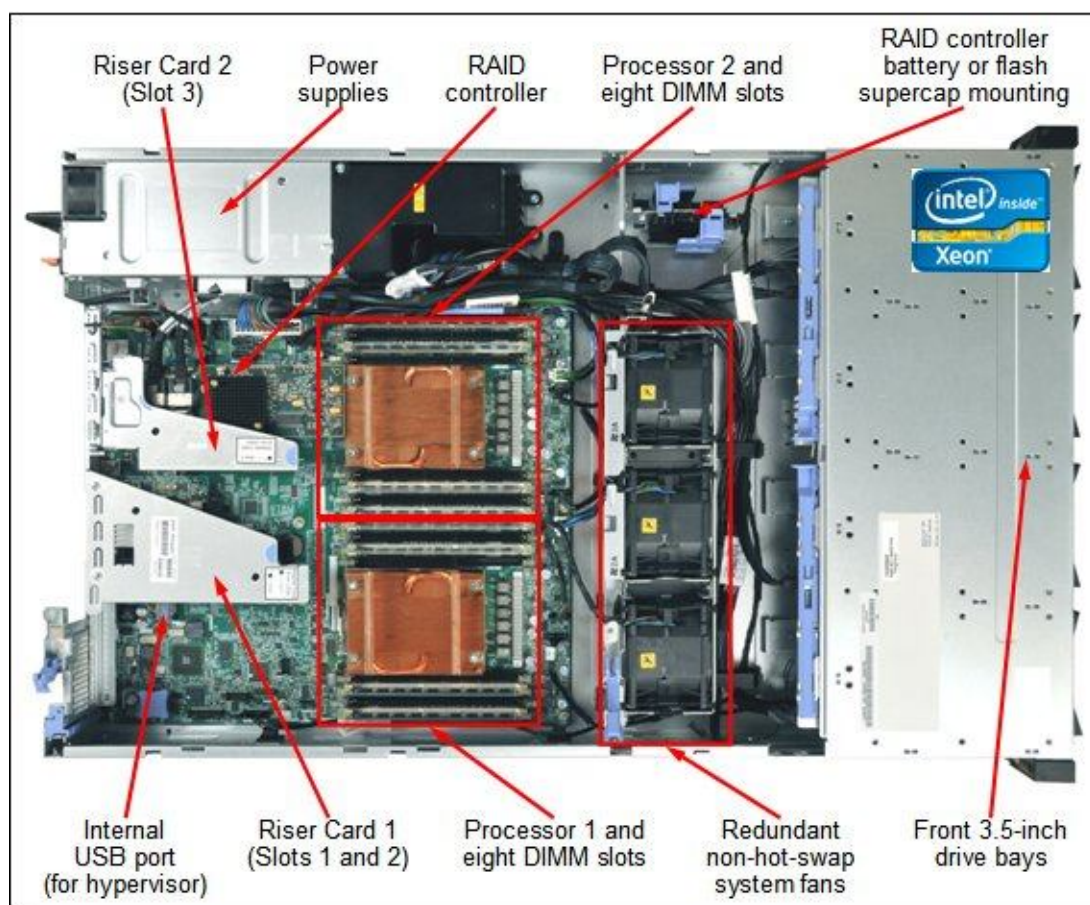


Figure 4. Inside view of the IBM System x3650 M4 BD (with the rear drive cage removed)

Standard specifications

The following table lists the standard specifications.

Table 1. Standard specifications (part 1)

Components	Specification
Form factor	2U rack.
Processor	Up to two Intel Xeon processor E5-2600 v2 product family processors with 12 cores (up to 2.4 GHz), 10 cores (up to 2.8 GHz), eight or six cores (up to 2.6 GHz) or four cores (up to 2.5 GHz), one QPI link up to 8.0 GTps, up to 1866 MHz memory speed, up to 30 MB L3 cache.
Chipset	Intel C602J.
Memory	Up to 16 DIMM sockets (eight DIMMs per processor). UDIMMs, RDIMMs, and LRDIMMs are supported, but memory types cannot be intermixed. DIMM speeds are up to 1866 MHz.
Memory maximums	With UDIMMs: Up to 128 GB with 16x 8 GB UDIMMs and two processors With RDIMMs: Up to 256 GB with 16x 16 GB RDIMMs and two processors With LRDIMMs: Up to 512 GB with 16x 32 GB LRDIMMs and two processors
Memory protection	ECC, Chipkill, memory mirroring, and memory rank sparing.
Drive bays	Up to fourteen 3.5-inch SAS/SATA hot-swap drive bays (12 standard, two with the optional rear backplane).
Maximum internal storage	Up to 56 TB with 4 TB 3.5-inch NL SAS/SATA HS HDDs, or up to 7.2 TB with 512 GB 3.5-inch SATA HS SSDs. An intermix of SAS/SATA is supported.
RAID support	RAID 0, 1, and 10 with H1110 (rear drives only), M1115, M5110, or M5210. Upgrades to RAID 5 and 50 are available for M1115. Upgrades to RAID 5 and 50 are available for M5110 (zero-cache; 512 MB battery-backed cache; 512 MB or 1 GB flash-backed cache) and M5210 (zero-cache; 1 GB cache with no backup; 1 GB or 2 GB flash-backed cache). Upgrade to RAID 6 or 60 is available for M5110 and M5210 with caches.
Optical drive bays	None.
Tape drive bays	None.
Network interfaces	Three integrated Gigabit Ethernet 1000BASE-T RJ-45 ports (Intel I350-AM4); two optional 10 GbE ports on the mezzanine LOM cards.
Ports	Two USB 2.0 ports on the front. Four USB 2.0, one DB-15 video, one DB-9 serial, and four RJ-45 GbE network ports on the rear. One internal USB port for hypervisor (support is planned for later in 2014).
Cooling	IBM Calibrated Vectored Cooling with three redundant non-hot-swap fans; each fan has two motors. Two additional non-hot-swap fans in the rear drive assembly.
Power supply	Up to two redundant hot-swap 750 W HE AC or 900 W HE AC power supplies (all AC power supplies are 80 PLUS certified).
Hot-swap parts	Hard disk drives, power supplies.

Table 1. Standard specifications (part 2)

Components	Specification
I/O expansion slots	Up to three slots, depending on the riser cards installed. The slots are as follows: <ul style="list-style-type: none"> Slot 1: PCIe 3.0 x8 (x8-wired), optional PCIe 3.0 x16 (x16-wired); full-height (also supports low profile adapters with the 3U bracket), half-length Slot 2: PCIe 3.0 x8 (x8-wired); low-profile, half-length (not present if an optional x16-wired slot 1 riser is used) Slot 3: PCIe 3.0 x8 (x8-wired); dedicated slot for ServeRAID adapter
Systems management	UEFI, IBM Integrated Management Module II (IMM2), Predictive Failure Analysis, basic light path diagnostics, Automatic Server Restart, IBM Systems Director and IBM Systems Director Active Energy Manager, and IBM ServerGuide. Optional IMM Advanced FoD Upgrade for remote presence (graphics, keyboard and mouse, and virtual media).
Security features	Power-on password, administrator's password, and Trusted Platform Module (TPM).
Video	Matrox G200eR2 with 16 MB memory integrated into the IMM2. Maximum resolution is 1600x1200 at 75 Hz with 16 M colors.
Operating systems supported	Red Hat Enterprise Linux 5 and 6 (both x86 and x64), SUSE Linux Enterprise Server 11 (x86 and x64).
Limited warranty	Three-year customer-replaceable unit and onsite limited warranty with 9x5/NBD.
Service and support	Optional service upgrades (country-specific) are available through IBM ServicePac® offerings: 4-hour or 2-hour response time, 8 hours fix time, one-year or two-year warranty extension, remote technical support for IBM hardware and selected IBM and third-party (Linux) software.
Dimensions	Height: 86 mm (3.4 in.), width: 447 mm (17.6 in.), depth: 749 mm (29.5 in.)
Weight	Minimum configuration: 16.4 kg (36.2 lb), maximum: 29.8 kg (65.7 lb)

The x3650 M4 BD servers are shipped with the following items:

- Statement of Limited Warranty
- Important Notices
- Rack Installation Instructions
- Documentation CD containing *Installation and User's Guide*
- Rail kit (static rails, non-sliding; no cable management arm included)
- One 2.8 m, 10A/100-250 V, C13 to IEC 320-C14 rack power cable

Standard models

The following table lists the standard models.

Table 2. Standard models

MTM*	Intel Xeon processor† (2 maximum)	Memory (RDIMMs)	RAID	Drive bays	Drives	Onboard NIC	I/O slots (std / max)	Optical drive	Power supply (std / max)
Models announced January 2014									
5466-A2x	1x E5-2603 v2 4C 1.8GHz 10MB 1333MHz 80W	1x 8GB 1600MHz§	M5110	12x 3.5" HS / 14	Open bay	3x GbE, 2x 10 GbE	3 / 3	None	1x 750W HS / 2
5466-A4x	1x E5-2603 v2 4C 1.8GHz 10MB 1333MHz 80W	1x 8GB 1600MHz§	M5110	12x 3.5" HS / 14	Open bay	3x GbE	3 / 3	None	1x 750W HS / 2
5466-B2x	1x E5-2609 v2 4C 2.5GHz 10MB 1333MHz 80W	1x 8GB 1600MHz§	M5110 512MB Flash	12x 3.5" HS / 14	Open bay	3x GbE	3 / 3	None	1x 750W HS / 2
5466-C2x	1x E5-2620 v2 6C 2.1GHz 15MB 1600MHz 80W	1x 8GB 1600MHz	M5110 512MB Flash	12x 3.5" HS / 14	Open bay	3x GbE, 2x 10 GbE	3 / 3	None	1x 750W HS / 2
5466-C4x	1x E5-2620 v2 6C 2.1GHz 15MB 1600MHz 80W	1x 8GB 1600MHz	M5110 512MB Flash	12x 3.5" HS / 14	Open bay	3x GbE	3 / 3	None	1x 750W HS / 2
5466-D2x	1x E5-2630L v2 6C 2.4GHz 15MB 1600MHz 60W	1x 8GB 1600MHz	M5110 512MB Flash	12x 3.5" HS / 14	Open bay	3x GbE, 2x 10 GbE	3 / 3	None	1x 750W HS / 2
5466-F2x	1x E5-2660 v2 10C 2.2GHz 25MB 1866MHz 95W	1x 8GB 1600MHz§	H1110, N2115	12x 3.5" HS / 14	Open bay	3x GbE, 2x 10 GbE	3 / 3	None	1x 900W HS / 2
5466-F4x	1x E5-2660 v2 10C 2.2GHz 25MB 1866MHz 95W	1x 8GB 1600MHz§	H1110, N2115	12x 3.5" HS / 14	Open bay	3x GbE	3 / 3	None	1x 900W HS / 2
5466-G2x	1x E5-2695 v2 12C 2.4GHz 30MB 1866MHz 115W	1x 8GB 1600MHz§	M5110 1GB Flash	12x 3.5" HS / 14	Open bay	3x GbE	3 / 3	None	1x 900W HS / 2

* x in the Machine Type Model (MTM) represents a country-specific letter (for example, the EMEA MTM is 5466-A2G, and the US MTM is 5466-A2G). Ask an IBM representative for specifics.

† Processor detail: Processor quantity and model, number of cores, core speed, L3 cache, memory speed, and TDP.

§ For models A2x, A4x, and B2x, the standard DIMM is rated at 1600 MHz, but operates at up to 1333 MHz to match the processor memory speed. Conversely, for models F2x, F4x, and G2x, the processor memory speed is rated at 1866 MHz, but operates at up to 1600 MHz to match the rated speed of the installed DIMM. Actual memory speed maximums depend on several factors, as described in "Memory options".

For more information about the standard features of the server, see the "Specifications" section.

Express models

The following table lists the express models.

Table 3. Express models

MTM*	Intel Xeon processor† (2 maximum)	Memory (RDIMMs)	RAID	Drive bays	Drives	Onboard NIC	I/O slots (std / max)	Optical drive	Power supply (std / max)
Europe, Middle East, and Africa									
5466-E1x	1x E5-2620 v2 6C 2.1GHz 15MB 1600MHz 80W	1x 8GB 1600MHz	M5110	12x 3.5" HS / 14	Open bay	3x GbE	3 / 3	None	1x 750W HS / 2

* x in the Machine Type Model (MTM) represents a country-specific letter (for example, the EMEA MTM is 5466-A2G, and the US MTM is 5466-A2G). Ask an IBM representative for specifics.

† Processor detail: Processor quantity and model, number of cores, core speed, L3 cache, memory speed, and TDP.

Processor options

The x3650 M4 BD supports the processor options that are listed in the following table. The server supports up to two Intel Xeon processor E5-2600 v2 product family processors. This table shows which server models have each processor standard. If there is no corresponding *where-used* model for a particular processor, this processor is only available through CTO.

Table 4. Processor options

Part number	Feature codes*	Description	Standard models where used
00AL138	A4RX / A4S6	Intel Xeon Processor E5-2603 v2 4C 1.8GHz 10MB Cache 1333MHz 80W	A2x, A4x
00AL139	A4RY / A4S7	Intel Xeon Processor E5-2609 v2 4C 2.5GHz 10MB Cache 1333MHz 80W	B2x
00AL140	A4RZ / A4S8	Intel Xeon Processor E5-2620 v2 6C 2.1GHz 15MB Cache 1600MHz 80W	C2x, C4x
00AL141	A4S0 / A4S9	Intel Xeon Processor E5-2630 v2 6C 2.6GHz 15MB Cache 1600MHz 80W	-
00AL142	A4S1 / A4SE	Intel Xeon Processor E5-2630L v2 6C 2.4GHz 15MB Cache 1600MHz 60W	D2x
00AL143	A4S2 / A4SC	Intel Xeon Processor E5-2640 v2 8C 2.0GHz 20MB Cache 1600MHz 95W	-
00AL145	A4S4 / A4SA	Intel Xeon Processor E5-2650 v2 8C 2.6GHz 20MB Cache 1866MHz 95W	-
00AL146	A4S5 / A4SD	Intel Xeon Processor E5-2650L v2 10C 1.7GHz 25MB Cache 1600MHz 70W	-
00AL144	A4S3 / A4SB	Intel Xeon Processor E5-2660 v2 10C 2.2GHz 25MB Cache 1866MHz 95W	F2x, F4x
00AL148	A4TA / A4TG	Intel Xeon Processor E5-2670 v2 10C 2.5GHz 25MB Cache 1866MHz 115W	-
00AL149	A4TB / A4TH	Intel Xeon Processor E5-2680 v2 10C 2.8GHz 25MB Cache 1866MHz 115W	-
00AL147	A4T9 / A4TF	Intel Xeon Processor E5-2695 v2 12C 2.4GHz 30MB Cache 1866MHz 115W	G2x

* The first feature code is for the first processor; the second feature code is for the second processor.

Memory options

IBM DDR3 memory is compatibility tested and tuned for optimal System x performance and throughput. IBM memory specifications are integrated into the light path diagnostics for immediate system performance feedback and optimum system uptime. From a service and support standpoint, IBM memory automatically assumes the IBM system warranty, and IBM provides service and support worldwide.

The IBM System x3650 M4 BD supports DDR3 memory. The server supports up to eight DIMMs when one processor is installed and up to 16 DIMMs when two processors are installed. Each processor has four memory channels, and there are two DIMMs per channel.

The following rules apply when selecting the memory configuration:

- The server supports UDIMMs, RDIMMs, and LRDIMMs.
- Mixing different types of memory (UDIMMs, RDIMMs, and LRDIMMs) is not supported.
- Mixing 1.5 V and 1.35 V DIMMs is not supported.
- The maximum number of ranks per one channel is eight (with the exception of Load Reduced DIMMs where more than eight ranks are supported because one quad-rank LRDIMM provides the reduced electrical load on a memory bus).
- The maximum quantity of DIMMs that can be installed in the server depends on the number of processors, DIMM type, rank, and operating voltage, as shown in the "Max. qty supported" row in Table 5.
- All DIMMs in the server operate at the same speed, which is determined as the lowest value of:
 - Memory speed that is supported by the specific processor.
 - Lowest of maximum operating speeds for selected memory configuration that depends on rated speed, operating voltage, and quantity of DIMMs per channel, as shown under "Maximum operating speed" section in the table.

The following memory protection technologies are supported:

- ECC
- Chipkill (for x4-based memory DIMMs)
- Memory mirroring
- Memory rank sparing

Chipkill works only in independent channel mode (the default is operational mode) and supports only x4-based memory DIMMs.

If memory mirroring is used, then DIMMs must be installed in pairs (a minimum of one pair per each processor, and a maximum of two pairs per processor), and both DIMMs in a pair must be identical in type and size.

If memory rank sparing is used, then two single-rank or dual-rank DIMMs must be installed per populated channel (the DIMMs do not need to be identical). In rank sparing mode, one rank of a DIMM in each populated channel is reserved as spare memory. The size of a rank varies depending on the DIMMs installed.

Chipkill, memory mirroring, and memory rank sparing modes are mutually exclusive. Only one operational memory mode can be enabled on a server, and it is a system-wide setting.

The following table (Parts 1 and 2) shows the characteristics of the supported DIMMs. Tables cells that are highlighted with a gray background indicate when the combination of DIMM voltage and the number of DIMMs per channel still allows the DIMMs to operate at a rated speed.

Table 5. Maximum memory speeds (Part 1: RDIMMs)

DIMM specification	RDIMM					
Rank	Single rank			Dual rank		
Part numbers	00D5024 (4 GB) 00D5036 (8 GB)		00D5020 (4 GB) 00D5032 (8 GB)	00D5044 (8 GB) 46W0672 (16 GB)		00D5048 (16 GB)
Rated speed	1600 MHz		1866 MHz	1600 MHz		1866 MHz
Rated voltage	1.35 V		1.5 V	1.35 V		1.5 V
Operating voltage	1.35 V	1.5 V	1.5 V	1.35 V	1.5 V	1.5 V
Max qty supported*	16	16	16	16	16	16
Max DIMM capacity	8 GB	8 GB	8 GB	16 GB	16 GB	16 GB
Max memory capacity	128 GB	128 GB	128 GB	256 GB	256 GB	256 GB
Max. memory at rated speed	None**	128 GB	64 GB	None**	256 GB	256 GB
Maximum operating speed						
1 DIMM per channel	1333 MHz	1600 MHz	1866 MHz	1333 MHz	1600 MHz	1866 MHz
2 DIMMs per channel	1333 MHz	1600 MHz	1600 MHz	1333 MHz	1600 MHz	1866 MHz

* The maximum quantity that is supported is shown for two processors installed.

** Rated speed is not supported. Memory DIMMs always operate at speeds lower than rated.

Table 5. Maximum memory speeds (Part 2: UDIMMs and LRDIMMs)

DIMM specification	UDIMM		LRDIMM
Rank	Dual rank		Quad rank
Part number	00D5016 (8 GB)		46W0761 (32 GB)
Rated speed	1600 MHz		1866 MHz
Rated voltage	1.35 V		1.5 V
Operating voltage	1.35 V	1.5 V	1.5 V
Max. qty supported*	16	16	16
Max. DIMM capacity	8 GB	8 GB	32 GB
Max. memory capacity	128 GB	128 GB	512 GB
Max. memory at rated speed	None**	128 GB	256 GB
Maximum operating speed			
1 DIMM per channel	1333 MHz	1600 MHz	1866 MHz
2 DIMMs per channel	1333 MHz	1600 MHz	1600 MHz

* Maximum quantity that is supported is shown for two processors installed.

** Rated speed is not supported. Memory DIMMs always operate at speeds lower than rated.

The following table lists the memory options that are available for the x3650 M4 BD server.

Table 6. Memory options

Part number	Feature code	Description	Maximum supported	Standard models where used
UDIMMs				
00D5016	A3QC	8GB (1x8GB, 2Rx8, 1.35V) PC3L-12800 CL11 ECC DDR3 1600MHz LP UDIMM	16 (8 per CPU)	-
RDIMMs - 1600 MHz				
00D5024	A3QE	4GB (1x4GB, 1Rx4, 1.35V) PC3L-12800 CL11 ECC DDR3 1600MHz LP RDIMM	16 (8 per CPU)	-
00D5036	A3QH	8GB (1x8GB, 1Rx4, 1.35V) PC3L-12800 CL11 ECC DDR3 1600MHz LP RDIMM	16 (8 per CPU)	A2x, A4x, B2x, C2x, C4x, D2x, F2x, F4x, G2x
00D5044	A3QK	8GB (1x8GB, 2Rx8, 1.35V) PC3L-12800 CL11 ECC DDR3 1600MHz LP RDIMM	16 (8 per CPU)	-
46W0672	A3QM	16GB (1x16GB, 2Rx4, 1.35V) PC3L-12800 CL11 ECC DDR3 1600MHz LP RDIMM	16 (8 per CPU)	-
RDIMMs - 1866 MHz				
00D5020	A3QD	4GB (1x4GB, 1Rx4, 1.5V) PC3-14900 CL13 ECC DDR3 1866MHz LP RDIMM	16 (8 per CPU)	-
00D5032	A3QG	8GB (1x8GB, 1Rx4, 1.5V) PC3-14900 CL13 ECC DDR3 1866MHz LP RDIMM	16 (8 per CPU)	-
00D5048	A3QL	16GB (1x16GB, 2Rx4, 1.5V) PC3-14900 CL13 ECC DDR3 1866MHz LP RDIMM	16 (8 per CPU)	-
LRDIMMs				
46W0761	A47K	32GB (1x32GB, 4Rx4, 1.5V) PC3-14900 CL13 ECC DDR3 1866MHz LP LRDIMM	16 (8 per CPU)	-

Internal storage

The x3650 M4 BD server supports the following internal storage configurations:

- Twelve 3.5-inch SAS/SATA hot-swap drive bays
- Fourteen 3.5-inch SAS/SATA hot-swap drive bays

Standard models ship with twelve 3.5-inch SAS/SATA hot-swap drive bays, and they can also be upgraded to fourteen 3.5-inch hot-swap drive bay models with the optional rear drive backplane (rear cage assembly comes standard with the server). The following table shows the internal storage expansion options that are available.

Table 7. Internal storage expansion options

Part number	Feature code	Description	Maximum supported	Standard models where used
00FK886	A4RT	Rear Backplane, 2x3.5" HDD Extension To Front Array (14-HDD Array)	1	-
00AL184	A4RU	Rear Backplane, 2x3.5" HDD Separate Array	1	-

Option 00FK886 is used to upgrade standard (see Table 2) or custom (CTO or special bid) models with twelve 3.5-inch hot-swap drive bays to fourteen 3.5-inch hot-swap drive bays; all 14 drives are connected to the same storage controller (M1115, M5110, M5210, or N2115).

Option 00AL184 is used to upgrade standard (see Table 2) or custom (CTO or special bid) models with twelve 3.5-inch hot-swap drive bays to fourteen 3.5-inch hot-swap drive bays; two rear drives are connected to the first RAID controller (H1110), and 12 drives on the front of the server are connected to a separate RAID controller (M1115, M5110, M5210, or N2115). In addition, x3650 M4 BD supports booting from the rear drives in the configurations with the H1110 controller.

Controllers for internal storage

The following table (Parts 1 and 2) lists the storage controllers and the additional options that are used for the internal storage of the x3650 M4 BD server.

Table 8. RAID controllers and HBAs for internal storage (Part 1: 6 Gbps SAS)

Part number	Feature code	Description	Maximum supported	Standard models where used
81Y4492	A1XL	ServeRAID H1110 SAS/SATA Controller	1	F2x, F4x
81Y4448	A1MZ	ServeRAID M1115 SAS/SATA Controller	1	-
81Y4481	A347	ServeRAID M5110 SAS/SATA Controller	1	A2x, A4x, B2x, C2x, C4x, D2x, G2x
00AE882	A4Z7	ServeRAID F5115-200GB SAS/SATA Controller	1	-
00AE886	A4Z8	ServeRAID F5115-800GB SAS/SATA Controller	1	-
46C8988	A3MW	N2115 SAS/SATA HBA for IBM System x	1	F2x, F4x
Hardware upgrades for the M5110 and M5110e				
81Y4508	A22E	ServeRAID M5100 Series Battery Kit	1*	-
81Y4484	A1J3	ServeRAID M5100 Series 512MB Cache/RAID 5 Upgrade	1	-
81Y4487	A1J4	ServeRAID M5100 Series 512MB Flash/RAID 5 Upgrade	1	B2x, C2x, C4x, D2x
81Y4559	A1WY	ServeRAID M5100 Series 1GB Flash/RAID 5 Upgrade	1	G2x
Feature on Demand upgrades for the M1115, M5110, and M5110e				
81Y4542	A1X1	ServeRAID M1100 Series Zero Cache/RAID 5 Upgrade	1	-
81Y4544	A1X2	ServeRAID M5100 Series Zero Cache/RAID 5 Upgrade	1	-
90Y4318	A2MD	ServeRAID M5100 Series SSD Caching Enabler	1	-
90Y4273	A2MC	ServeRAID M5100 Series SSD Performance Key	1	-
81Y4546	A1X3	ServeRAID M5100 Series RAID 6 Upgrade	1†	-

* The ServeRAID M5100 Series Battery Kit (81Y4508) is supported only with ServeRAID M5100 Series 512MB Cache/RAID 5 Upgrade (81Y4484).

† The ServeRAID M5100 Series RAID 6 Upgrade (81Y4546) requires 512 MB or 1 GB cache upgrades.

Table 8. RAID controllers and HBAs for internal storage (Part 2: 12 Gbps SAS)

Part number	Feature code	Description	Maximum supported	Standard models where used
46C9110	A3YZ	ServeRAID M5210 SAS/SATA Controller	1	-
Hardware upgrades for the M5210				
47C8656	A3Z0	ServeRAID M5200 Series 1GB Cache/RAID 5 Upgrade	1	-
47C8660	A3Z1	ServeRAID M5200 Series 1GB Flash/RAID 5 Upgrade	1	-
47C8664	A3Z2	ServeRAID M5200 Series 2GB Flash/RAID 5 Upgrade	1	-
Feature on Demand upgrades for the M5210				
47C8708	A3Z6	ServeRAID M5200 Series Zero Cache/RAID 5 Upgrade	1	-
47C8706	A3Z5	ServeRAID M5200 Series RAID 6 Upgrade	1*	-
47C8710	A3Z7	ServeRAID M5200 Series Performance Accelerator	1*	-
47C8712	A3Z8	ServeRAID M5200 Series SSD Caching Enabler	1*	-

* Requires cache memory upgrade (47C8656, 47C8660, or 47C8664).

The internal storage controller other than H1110 is installed into a dedicated PCIe slot (slot 3). In the configurations with the H1110, the H1110 is installed in PCIe slot 2, and the second storage controller is installed in slot 3.

The following table lists the drive types and internal drive bay configurations that are supported by the storage controllers (SAS HDDs include both SAS and NL SAS HDDs, and SATA HDDs include both SATA and NL SATA HDDs).

Table 9. Drive types and internal drive bay configurations that are supported by the RAID controllers

RAID controller or HBA	Drive type	12x 3.5-inch hot-swap (front)	2x 3.5-inch hot-swap (rear)
ServeRAID H1110	SAS HDD	No support	Yes
	SATA HDD	No support	Yes
	SATA SSD	No support	Yes
ServeRAID M1115	SAS HDD	Yes	Yes*
	SATA HDD	Yes	Yes*
	SATA SSD	Yes	Yes*
ServeRAID M5110 ServeRAID M5210 ServeRAID F5115	SAS HDD	Yes	Yes*
	SATA HDD	Yes	Yes*
	SATA SSD	Yes	Yes*
N2115	SAS HDD	Yes	Yes*
	SATA HDD	Yes	Yes*
	SATA SSD	Yes	Yes*

* The rear drives are connected to the same RAID controller or HBA as the front drives. A single RAID controller or HBA is used for both front and rear drives.

The ServeRAID H1110 adapter has the following specifications:

- Four internal 6 Gbps SAS/SATA ports
- Up to 6 Gbps throughput per port
- One x4 mini-SAS internal connector (SFF-8087)
- Based on the LSI SAS2004 6 Gbps RAID on Chip (ROC) controller
- PCIe 2.0 x4 host interface
- Supports RAID 0, 1, 1E, and 10
- Connects to up to four SAS or SATA drives (SAS expanders are not supported.)

The ServeRAID M1115 SAS/SATA Controller has the following specifications:

- Eight internal 6 Gbps SAS/SATA ports
- Up to 6 Gbps throughput per port
- Two x4 mini-SAS internal connectors (SFF-8087)
- Supports connections to SAS/SATA drives and SAS Expanders
- Supports RAID 0, 1, and 10
- Supports RAID 5 and 50 with optional M1100 Series RAID 5 upgrades
- PCIe 2.0 x8 host interface
- Based on the LSI SAS2008 6 Gbps ROC controller

The ServeRAID M5110 SAS/SATA Controller has the following specifications:

- Eight internal 6 Gbps SAS/SATA ports
- Up to 6 Gbps throughput per port
- Two x4 mini-SAS internal connectors (SFF-8087)
- Supports connections to SAS/SATA drives and SAS Expanders
- Supports RAID 0, 1, and 10
- Supports RAID 5 and 50 with optional M5100 Series RAID 5 upgrades
- Supports RAID 6 and 60 with the optional M5100 Series RAID 6 upgrade
- Supports 512 MB battery-backed cache or 512 MB or 1 GB flash-backed cache
- Support for SSD performance optimization with the optional M5100 Series Performance Accelerator and SSD Caching Enabler
- PCIe 3.0 x8 host interface
- Based on the LSI SAS2208 6 Gbps ROC controller

The ServeRAID M5210 SAS/SATA Controller has the following specifications:

- Eight internal 12 Gbps SAS/SATA ports
- Up to 12 Gbps throughput per port
- Two x4 HD mini-SAS internal connectors (SFF-8643)
- Supports connections to SAS/SATA drives and SAS Expanders
- Supports RAID 0, 1, and 10
- Supports RAID 5 and 50 with optional M5200 Series RAID 5 upgrades
- Supports RAID 6 and 60 with the optional M5200 Series RAID 6 upgrade
- Supports 1 GB non-backed cache or 1 GB or 2 GB flash-backed cache
- PCIe 3.0 x8 host interface
- Based on the LSI SAS3108 12 Gbps ROC controller

The IBM N2115 SAS/SATA HBA has the following specifications:

- Eight internal 6 Gbps SAS/SATA ports
- Up to 6 Gbps throughput per port
- Two x4 mini-SAS internal connectors (SFF-8087)
- Supports connections to SAS/SATA HDDs and SATA SSDs
- Optimized for SSD performance
- No RAID support
- PCIe 3.0 x8 host interface
- Based on the LSI SAS2308 6 Gbps controller

The ServeRAID F5115 SAS/SATA Controllers have the following specifications:

- Four internal 6 Gbps SAS/SATA ports
- Up to 6 Gbps throughput per port
- One x4 mini-SAS internal connector (SFF-8087)
- Supports connections to SAS/SATA drives and SAS Expanders
- Supports RAID 0, 1, 10, 5, 50, 6, and 60
- Includes 1 GB of cache memory
- Includes 200 GB or 800 GB of onboard eMLC flash memory (configurable as RAID 0 or RAID 1) for boot, data, or caching
- PCIe 3.0 x8 host interface
- Based on the LSI SAS2208 6 Gbps ROC controller

For more information, see the list of IBM Redbooks® Product Guides in the RAID adapters category:
<http://www.redbooks.ibm.com/portals/systemx?Open&page=pg&cat=raid>

Internal drive options

The following table lists the hard disk drive options for the internal disk storage of the x3650 M4 BD server.

Table 10. Disk drive options for internal disk storage

Part number	Feature code	Description	Maximum supported
3.5" SAS Hot-Swap HDDs			
49Y6092	A3DV	IBM 300GB 15K 6Gbps SAS 3.5" G2HS HDD	14
49Y6097	A3DW	IBM 450GB 15K 6Gbps SAS 3.5" G2HS HDD	14
49Y6102	A3DX	IBM 600GB 15K 6Gbps SAS 3.5" G2HS HDD	14
3.5" NL SAS Hot-Swap HDDs			
90Y8567	A26M	IBM 1TB 7.2K 6Gbps NL SAS 3.5" G2HS HDD	14
90Y8572	A2U0	IBM 2TB 7.2K 6Gbps NL SAS 3.5" G2HS HDD	14
90Y8577	A2R2	IBM 3TB 7.2K 6Gbps NL SAS 3.5" G2HS HDD	14
49Y6210	A4AF	IBM 4TB 7.2K 6Gbps NL SAS 3.5" G2HS HDD	14
3.5" NL SATA Hot-Swap HDDs			
81Y9786	A22Y	IBM 500GB 7.2K 6Gbps NL SATA 3.5" G2HS HDD	14
81Y9790	A22P	IBM 1TB 7.2K 6Gbps NL SATA 3.5" G2HS HDD	14
81Y9794	A22T	IBM 2TB 7.2K 6Gbps NL SATA 3.5" G2HS HDD	14
81Y9798	A22S	IBM 3TB 7.2K 6Gbps NL SATA 3.5" G2HS HDD	14
49Y6002	A3W9	IBM 4TB 7.2K 6Gbps NL SATA 3.5" G2HS HDD	14
3.5" SATA Hot-Swap SSDs			
00W1286	A3G1	IBM 64GB SATA 3.5" MLC HS Enterprise Value SSD	14
00W1291	A3G3	IBM 128GB SATA 3.5" MLC HS Enterprise Value SSD	14
00W1296	A3G4	IBM 256GB SATA 3.5" MLC HS Enterprise Value SSD	14
00W1301	A3G2	IBM 512GB SATA 3.5" MLC HS Enterprise Value SSD	14

Internal backup units

The x3650 M4 BD server does not support internal tape drive options or other internal backup units. However, it can be attached to the external tape drives by using USB or SAS connectivity (see Table 25).

Optical drives

The x3650 M4 BD server does not support an internal optical drive.

I/O expansion options

The x3650 M4 BD server supports up to three PCIe slots with different riser cards installed into two riser sockets on the system board (one riser socket supports the installation of one riser card).

The slot form factors with 1U risers (models with the rear HDD cage assembly) are as follows:

- Slot 1: PCIe 3.0 x8 (x8-wired), optional PCIe 3.0 x16 (x16-wired); full-height (also supports low profile adapters with the 3U bracket), half-length
- Slot 2: PCIe 3.0 x8 (x8-wired); low-profile, half-length (not present if an optional x16-wired slot 1 riser is used)
- Slot 3: PCIe 3.0 x8 (x8-wired); dedicated slot for ServeRAID adapter

The following table lists the I/O riser card options.

Table 11. I/O riser card options

Part number	Feature code	Description	Maximum supported	Standard models where used
1U Riser 1 option (supplies slots 1 and 2)				
00AL182	A4T8	1U Riser Card, One PCIe x16 slot	1	-
00AL181	A4T6	1U Riser Card, Two PCIe x8 slots	1	A2x, A4x, B2x, C2x, C4x, D2x, F2x, F4x, G2x
1U Riser 2 option (supplies slot 3)				
00AL183	A4T7	1U Riser Card, One PCIe x8 slot (For Slotless RAID only)	1	A2x, A4x, B2x, C2x, C4x, D2x, F2x, F4x, G2x

Network adapters

The x3650 M4 BD supports three integrated Gigabit Ethernet ports. Integrated NIC has the following features:

- An Intel I350-AM4 chip
- Three Gigabit Ethernet ports
- NIC Teaming (load balancing and failover)

- Ethernet features:
 - 1 Gb Ethernet IEEE 802.3, 802.3u, and 802.3ab PHY specifications compliant
 - Integrated PHY for 10/100/1000 Mbps for multispeed, full, and half-duplex auto-negotiation
 - IEEE 802.3x and 802.3z compliant flow control support with software-controllable Rx thresholds and Tx pause frames
 - Automatic cross-over detection function (MDI/MDI-X)
 - IEEE 1588 protocol and 802.1AS implementation
 - IEEE802.3az - Energy Efficient Ethernet (EEE)
 - Full wake-up support
 - Advanced Power Management (APM) support
 - Advanced Configuration and Power Interface (ACPI) specification v2.0c
 - Magic packet wake-up enable
- I/O Virtualization Features:
 - Eight transmit (Tx) and receive (Rx) queue pairs per port
 - Flexible port partitioning: 32 virtual functions (VF) with four ports or 16 VFs with two ports
 - Rx/Tx round-robin scheduling
 - Traffic isolation and traffic steering
 - Virtual machine (VM) to VM packet forwarding (packet loopback)
 - MAC and VLAN anti-spoofing
 - Malicious driver detection
 - Storm control
 - Per-pool statistics, off loads, and jumbo support
 - Independent Function Level Reset (FLR) for physical and virtual functions
 - IEEE 802.1q Virtual Local Area Network (VLAN) support with VLAN tag insertion, stripping, and packet filtering for up to 4096 VLAN tags
 - IEEE 802.1q advanced packet filtering
 - Mirroring rules
 - Support for simple VEPA
 - VF promiscuous modes
- Stateless offload and performance features:
 - TCP/UDP, IPv4 checksum offloads (Rx/ Tx/Large-send); extended Tx descriptors
 - IPv6 support for IP/TCP and IP/UDP receive checksum offload
 - Tx TCP segmentation offload (IPv4 and IPv6)
 - Transmit Segmentation Offloading (TSO)
 - Interrupt throttling control
 - Legacy and Message Signal Interrupt (MSI)
 - Message Signal Interrupt Extension (MSI-X)
 - Receive Side Scaling (RSS) for Windows
 - Scalable I/O for Linux environments (IPv4, IPv6, and TCP/UDP)
 - Support for packets up to 9.5 KB (jumbo frames)

The following table lists additional supported network adapters.

Table 12. Network adapters

Part number	Feature code	Description	Maximum supported
40 Gb Ethernet / FDR InfiniBand			
00D9550	A3PN	Mellanox ConnectX-3 40GbE / FDR IB VPI Adapter for IBM System x	2
10 Gb Ethernet			
94Y5180	A4Z6	Broadcom NetXtreme Dual Port 10GbE SFP+ Adapter for IBM System x	2
00AL185	A4XG	Broadcom Dual Port 10GbE SFP+ Embedded Adapter with Interposer*	1
49Y7910	A18Y	Broadcom NetXtreme II Dual Port 10GBaseT Adapter for IBM System x	2
00AL652	A4X6	Broadcom Single Port 10GbE SFP+ Embedded Adapter with Interposer*	1
00AL653	A4X7	Intel X520 Dual Port 10GbE SFP+ Embedded Adapter with Interposer*	1
49Y7960	A2EC	Intel X520 Dual Port 10GbE SFP+ Adapter for IBM System x	2
49Y7970	A2ED	Intel X540-T2 Dual Port 10GBaseT Adapter for IBM System x	2
00D9690	A3PM	Mellanox ConnectX-3 10GbE Adapter for IBM System x	2
90Y4600	A3MR	QLogic 8200 Dual Port 10GbE SFP+ VFA for IBM System x	2**
00Y5624	A3MT	QLogic 8200 VFA FCoE/iSCSI License for IBM System x (FoD)	2†
47C9952	A47H	Solarflare SFN5162F MR Dual Port 10GbE SFP+ Adapter for IBM System x	2
47C9960	A47J	Solarflare SFN6122F LL Dual Port 10GbE SFP+ Adapter for IBM System x	2
Gigabit Ethernet			
90Y9370	A2V4	Broadcom NetXtreme I Dual Port GbE Adapter for IBM System x	2
90Y9352	A2V3	Broadcom NetXtreme I Quad Port GbE Adapter for IBM System x	2
42C1780	2995	Broadcom NetXtreme II 1000 Express Dual Port Ethernet Adapter	2
49Y4220	5766	Broadcom NetXtreme II 1000 Express Quad Port Ethernet Adapter	2
49Y4230	5767	Intel Ethernet Dual Port Server Adapter I340-T2 for IBM System x	2
49Y4240	5768	Intel Ethernet Quad Port Server Adapter I340-T4 for IBM System x	2

* The embedded adapter is installed in a regular PCIe slot (slot 1) through an interposer that is included with the adapter.

** Virtual Fabric Adapters require SFP+ optical transceivers or DAC cables that must be purchased separately.

† One FCoE/iSCSI license per one QLogic 8200 Dual Port VFA.

For more information, see the list of IBM Redbooks Product Guides in the Ethernet and IB adapters category:

<http://www.redbooks.ibm.com/portals/systemx?Open&page=pg&cat=networkadapters>

Storage host bus adapters

The following table lists the storage HBAs that are supported by the x3650 M4 BD server.

Table 13. Storage adapters

Part number	Feature code	Description	Maximum supported
Fibre Channel - 16 Gb			
81Y1668	A2XU	Brocade 16Gb FC Single-port HBA for IBM System x	2
81Y1675	A2XV	Brocade 16Gb FC Dual-port HBA for IBM System x	2
81Y1662	A2W6	Emulex 16Gb FC Dual-port HBA for IBM System x	2
81Y1655	A2W5	Emulex 16Gb FC Single-port HBA for IBM System x	2
00Y3337	A3KW	QLogic 16Gb FC Single-port HBA for IBM System x	2
00Y3341	A3KX	QLogic 16Gb FC Dual-port HBA for IBM System x	2
Fibre Channel - 8 Gb			
46M6050	3591	Brocade 8Gb FC Dual-port HBA for IBM System x	2
46M6049	3589	Brocade 8Gb FC Single-port HBA for IBM System x	2
42D0494	3581	Emulex 8Gb FC Dual-port HBA for IBM System x	2
SAS			
46C9010	A3MV	N2125 SAS/SATA HBA for IBM System x	2

For more information, see the list of IBM Redbooks Product Guides in the Host bus adapters category:
<http://www.redbooks.ibm.com/portals/systemx?Open&page=pg&cat=hba>

PCIe SSD adapters

The x3650 M4 BD server supports the High IOPS SSD adapters that are listed in the following table.

Table 14. SSD adapters

Part number	Feature code	Description	Maximum supported
46C9078	A3J3	IBM 365GB High IOPS MLC Mono Adapter	1
46C9081	A3J4	IBM 785GB High IOPS MLC Mono Adapter	1
90Y4377	A3DY	IBM 1.2TB High IOPS MLC Mono Adapter	1

GPU adapters

The x3650 M4 BD server supports graphics processing units (GPUs) if the riser card 00AL182 (FC A4T8) is installed. The following table lists the supported GPUs.

Table 15. GPU adapters

Part number	Feature code	Description	Maximum supported
None*	A3WH	NVIDIA Quadro K600	1

* This adapter can be ordered only through CTO or special bid.

Power supplies

The server supports up to two redundant hot-swap 750 W AC or 900 W AC high efficient power supplies that are 80 PLUS certified. Standard models come with one 750 W AC or 900 W AC hot-swap power supply.

The following table lists the power supply options. An AC hot-swap power supply option ships standard with one 2.8m, 10A/100-250V, C13 to IEC 320-C14 rack power cable.

Table 16. Power supplies

Part number	Feature code	Description	Maximum supported	Standard models where used
00AL742	A4RV	IBM System x 750W High Efficiency Platinum AC Power Supply	2	A2x, A4x, B2x, C2x, C4x, D2x
00AL743	A4RW	IBM System x 900W High Efficiency Platinum AC Power Supply	2	F2x, F4x, G2x

Important: 95 W and 115 W processors require 900 W power supplies.

Integrated virtualization

The x3650 M4 BD server does not support integrated virtualization.

Remote management

The server contains IBM Integrated Management Module II (IMM2), which provides advanced service-processor control, monitoring, and an alerting function. If an environmental condition exceeds a threshold or if a system component fails, the IMM2 lights LEDs to help you diagnose the problem, records the error in the event log, and alerts you to the problem. Optionally, the IMM2 also provides a virtual presence capability for remote server management capabilities.

The IMM2 provides remote server management through industry-standard interfaces:

- Intelligent Platform Management Interface (IPMI) Version 2.0
- Simple Network Management Protocol (SNMP) Version 3
- Common Information Model (CIM)
- Web browser

The optional IBM Integrated Management Module Advanced Upgrade is required to enable the remote presence and blue-screen capture features. The remote presence feature provides the following functions:

- Remotely viewing video with graphics resolutions up to 1600x1200 at 75 Hz with up to 23 bits per pixel, regardless of the system state
- Remotely accessing the server using the keyboard and mouse from a remote client
- Mapping the CD or DVD drive, diskette drive, and USB flash drive on a remote client, and mapping ISO and diskette image files as virtual drives that are available for use by the server
- Uploading a diskette image to the IMM memory and mapping it to the server as a virtual drive

The blue-screen capture feature captures the video display contents before the IMM restarts the server when the IMM detects an operating system hang condition. A system administrator can use the blue-screen capture to assist in determining the cause of the hang condition. The following table lists the remote management option.

Table 17. Remote management option

Part number	Feature code	Description	Maximum supported
90Y3901	A1ML	IBM Integrated Management Module Advanced Upgrade	1

Light path diagnostics panel

The light path diagnostics panel allows systems engineers and administrators to easily and quickly diagnose hardware problems on the IBM System x servers. If a failure occurs, a light is illuminated on the front panel of the server (level 1 light path) to alert the systems administrator that there is a problem. This light directs the engineer or administrator directly to the failed component, which also has an illuminated LED near it (light path level 3), for example, the DIMM error LED on the system board.

x3650 M4 BD offers basic light path diagnostics, as shown in the following figure.

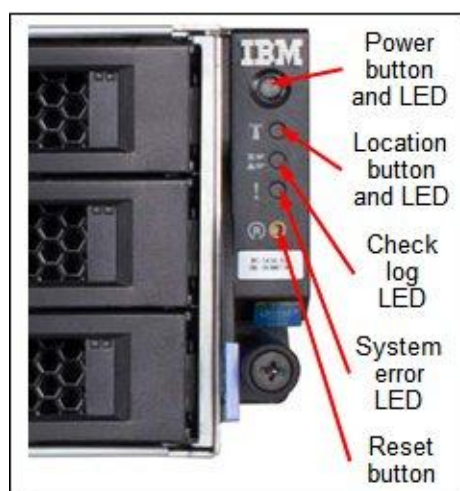


Figure 5. Basic (level 1) light path

Supported operating systems

The server supports the following operating systems:

- Red Hat Enterprise Linux 5 Server Edition
- Red Hat Enterprise Linux 5 Server with Xen x64 Edition
- Red Hat Enterprise Linux 5 Server x64 Edition
- Red Hat Enterprise Linux 6 Server Edition
- Red Hat Enterprise Linux 6 Server x64 Edition
- SUSE LINUX Enterprise Server 11 for AMD64/EM64T
- SUSE LINUX Enterprise Server 11 for x86
- SUSE LINUX Enterprise Server 11 with Xen for AMD64/EM64T

For the latest information about the specific versions and service levels that are supported and any other prerequisites, see the IBM ServerProven® website:

<http://www.ibm.com/systems/info/x86servers/serverproven/compat/us/nos/matrix.shtml>

Physical and electrical specifications

Dimensions and weight:

- Height: 86 mm (3.4 in.)
- Width: 447 mm (17.6 in.)
- Depth: 749 mm (29.5 in.)
- Weight:
 - o Minimum configuration: 16.4 kg (36.2 lb).
 - o Maximum configuration: 29.8 kg (65.6 lb).

Supported environment:

- Air temperature
 - Server on: 5 °C to 40 °C (41 °F to 104 °F); altitude: 0 to 950 m (3,117 ft).
 - Server on: 5 °C to 28 °C (41 °F to 82.4 °F); altitude: 950 m (3,117 ft) to 3,050 m (10,000 ft); de-rated maximum air temperature 1 °C per 175 m.
 - Server off: 5 °C to 45 °C (41 °F to 113 °F).
 - Shipment (non-operating): -40 °C to 60 °C (-40 °F to 140 °F).
- Humidity:
 - Server on: 8% - 85%, maximum dew point 24 °C (75 °F), maximum rate of change 5 °C/hr.
 - Server off: 8% - 85%, maximum dew point 27 °C (80.6 °F).
 - Shipment: 5% - 100%, maximum dew point 29 °C (84.2 °F).
- Design to ASHRAE Class A3, ambient of 36 °C to 40 °C (96.8 °F to 104 °F), with relaxed support:
 - Supports cloud like workload with no performance degradation acceptable (Turbo-Off).
 - Under no circumstance can any combination of worst case workload and configuration result in system shutdown or design exposure at 40 °C.
 - The worst-case workload (like Linpack, Turbo-On) might have performance degradation.
- Electrical
 - Models with 900 W power supplies:
 - 100 to 127 (nominal) V AC; 50 Hz or 60 Hz; 10 A
 - 200 to 240 (nominal) V AC; 50 Hz or 60 Hz; 5 A
 - Input kilovolt-amperes (kVA) (approximately):
 - Minimum configuration: 0.1 kVA
 - Maximum configuration: 0.9 kVA
 - Models with 750 W hot-swap power supplies:
 - 100 - 127 (nominal) V AC; 50 Hz or 60 Hz; 8.9 A
 - 200 - 240 (nominal) V AC; 50 Hz or 60 Hz; 4.5 A
 - Input kilovolt-amperes (kVA) (approximately):
 - Minimum configuration: 0.1 kVA
 - Maximum configuration: 0.75 kVA
- BTU output
 - Minimum configuration: 333 Btu/hr (98 watts)
 - Maximum configuration: 3074 Btu/hr (900 watts)
- Noise level
 - 6.6 bels (operating)
 - 6.6 bels (idle)

Warranty options

The x3650 M4 BD has a three-year onsite warranty with 9x5/next business day terms. IBM offers the warranty service upgrades through IBM ServicePac offerings, which are described in this section. An IBM ServicePac offering is a series of prepackaged warranty maintenance upgrades and post-warranty maintenance agreements with a well-defined scope of services, including service hours, response time, term of service, and service agreement terms and conditions.

IBM ServicePac offerings are country-specific, that is, each country might have its own service types, service levels, response times, and terms and conditions. Not all covered types of ServicePac offerings might be available in a particular country. For more information about the IBM ServicePac offerings that are available in your country, visit the IBM ServicePac Product Selector website:

<https://www-304.ibm.com/sales/gss/download/spst/servicepac>

The following table explains the warranty service definitions in more detail.

Table 18. Warranty service definitions

Term	Description
IBM onsite repair (IOR)	A service technician comes to the server's location for equipment repair.
24x7x2 hour	A service technician is scheduled to arrive at your client's location within two hours after remote problem determination is completed. We provide service around the clock, every day, including IBM holidays.
24x7x4 hour	A service technician is scheduled to arrive at your client's location within four hours after remote problem determination is completed. We provide service around the clock, every day, including IBM holidays.
9x5x4 hour	A service technician is scheduled to arrive at your client's location within four business hours after remote problem determination is completed. We provide service from 8:00 a.m. - 5:00 p.m. in the client's local time zone, Monday through Friday, excluding IBM holidays. If after 1:00 p.m. it is determined that onsite service is required, the client can expect the service technician to arrive the morning of the following business day. For noncritical service requests, a service technician arrives by the end of the following business day.
9x5 next business day	A service technician is scheduled to arrive at your client's location on the business day after we receive your call, following remote problem determination. We provide service from 8:00 a.m. - 5:00 p.m. in the client's local time zone, Monday through Friday, excluding IBM holidays.

In general, the types of IBM ServicePac offerings are as follows:

- Warranty and maintenance service upgrades:
 - One, two, three, four, or five years of 9x5 or 24x7 service coverage
 - Onsite repair from next business day to 2 or 4 hours
 - One or two years of warranty extension
- Remote technical support services:
 - One or three years with 24x7 coverage (severity 1) or 9x5/next business day for all severities
 - Installation and startup support for System x servers
 - Remote technical support for System x servers
 - Software support - Support Line:
 - Linux software
 - IBM Systems Director

Regulatory compliance

The server conforms to the following regulations:

- FCC - Verified to comply with Part 15 of the FCC Rules, Class A
- Canada ICES-003, issue 4, Class A
- UL/IEC 60950-1
- CSA C22.2 No. 60950-1
- NOM-019
- Argentina IEC60950-1
- Japan VCCI, Class A
- Australia/New Zealand AS/NZS CISPR 22, Class A
- IEC 60950-1(CB Certificate and CB Test Report)
- China CCC (GB4943), GB9254 Class A, GB17625.1
- Taiwan BSMI CNS13438, Class A; CNS14336-1
- Korea KN22, Class A; KN24
- Russia, Byelorussia, and Kazakhstan, TR CU 020/2011 and TR CU 004/2011
- CE Mark (EN55022 Class A, EN60950-1, EN55024, EN61000-3-2, and EN61000-3-3)
- CISPR 22, Class A
- TUV-GS (EN60950-1/IEC60950-1, EK1-ITB2000)

External disk storage expansion

The x3650 M4 BD supports attachments to the external storage expansion enclosures, such as the EXP2500 series, by using the ServeRAID M5120 SAS/SATA Controller. The x3650 M4 BD server can also be attached to supported external storage systems, such as the IBM System Storage® DS3500 series, by using the supported HBAs listed in Table 13.

The following table provides the ordering part numbers for the ServeRAID M5120 SAS/SATA Controller.

Table 19. Ordering part numbers and feature codes

Part number	Feature code	Description	Maximum supported
81Y4478	A1WX	ServeRAID M5120 SAS/SATA Controller for IBM System x	2
81Y4484	A1J3	ServeRAID M5100 Series 512MB Cache/RAID 5 Upgrade for IBM System x	2
81Y4487	A1J4	ServeRAID M5100 Series 512MB Flash/RAID 5 Upgrade for IBM System x	2
81Y4559	A1WY	ServeRAID M5100 Series 1GB Flash/RAID 5 Upgrade for IBM System x	2
81Y4508	A22E	ServeRAID M5100 Series Battery Kit for IBM System x	2
81Y4546	A1X3	ServeRAID M5100 Series RAID 6 Upgrade for IBM System x	1*
90Y4273	A2MC	ServeRAID M5100 Series SSD Performance Accelerator for IBM System x	1*
90Y4318	A2MD	ServeRAID M5100 Series SSD Caching Enabler for IBM System x	1*

* One M5100 Series FoD software license is required per server.

Important: The ServeRAID M5120 SAS/SATA Controller ships standard without a cache. One of the available cache upgrades (81Y4484, 81Y4487, or 81Y4559) is required for the M5120 adapter operations, and it must be purchased together with the controller.

The ServeRAID M5120 SAS/SATA Controller has the following specifications:

- Eight external 6 Gbps SAS/SATA ports
- Up to 6 Gbps throughput per port
- Two external x4 mini-SAS connectors (SFF-8088)
- Supports RAID 0, 1, and 10
- Supports RAID 5 and 50 with optional M5100 Series RAID 5 upgrades
- Supports RAID 6 and 60 with the optional M5100 Series RAID 6 upgrade
- Supports 512 MB battery-backed cache or 512 MB or 1 GB flash-backed cache (cache)
- PCIe 3.0 x8 host interface
- Based on the LSI SAS2208 6 Gbps ROC controller
- Supports connectivity to the EXP2512 and EXP2524 storage expansion enclosures

For more information, see the IBM Redbooks Product Guide *ServeRAID M5120 SAS/SATA Controller for IBM System x*, TIPS0858:

<http://www.redbooks.ibm.com/abstracts/tips0858.html?Open>

The ServeRAID M5120 SAS/SATA Controller supports connectivity to the IBM System Storage external expansion enclosures that are listed in the following table. Up to nine expansion enclosures can be daisy-chained per one M5120 external port. For better performance, distribute expansion enclosures evenly across both M5120 ports.

Table 20. IBM System Storage external expansion enclosures

Part number	Description	Maximum quantity supported per one M5120
174712X	IBM System Storage EXP2512 Express	18
174724X	IBM System Storage EXP2524 Express	9

The external SAS cables that are listed in the following table support connectivity between external expansion enclosures and the ServeRAID M5120 SAS/SATA Controller.

Table 21. External SAS cables for external storage expansion enclosures

Part number	Description	Maximum quantity supported per one enclosure
39R6531	IBM 3 m SAS Cable	1
39R6529	IBM 1 m SAS Cable	1

The following table lists the drives that are supported by EXP2512 external expansion enclosures.

Table 22. Drive options for EXP2512 external expansion enclosures

Part number	Description	Maximum quantity supported per one enclosure
3.5" NL SAS HS HDDs		
49Y1903	1TB 7,200 rpm 6Gb SAS NL 3.5" HDD	12
49Y1902	2TB 7,200 rpm 6Gb SAS NL 3.5" HDD	12
90Y8720	3TB 7,200 rpm 6Gb SAS NL 3.5" HDD	12
46W0975	4TB 7,200 rpm 6Gb SAS NL 3.5" HDD	12
3.5" SAS HS HDDs		
49Y1899	300GB 15,000 rpm 6Gb SAS 3.5" HDD	12
49Y1900	450GB 15,000 rpm 6Gb SAS 3.5" HDD	12
49Y1901	600GB 15,000 rpm 6Gb SAS 3.5" HDD	12

The following table lists the hard disk drives that are supported by EXP2524 external expansion enclosures.

Table 23. Drive options for EXP2524 external expansion enclosures

Part number	Description	Maximum quantity supported per one enclosure
2.5" NL SAS HS HDDs		
49Y1898	500GB 7,200 rpm 6Gb SAS NL 2.5" HDD	24
81Y9952	1TB 7,200 rpm 6Gb SAS NL 2.5" HDD	24
2.5" SAS HS HDDs		
49Y1896	146GB 15,000 rpm 6Gb SAS 2.5" HDD	24
81Y9944	300GB 15,000 rpm 6Gb SAS 2.5" HDD	24
00W1595	600GB 10,000 rpm 6Gb SAS 2.5" HDD	24
46W0970	900GB 10,000 rpm 6Gb SAS 2.5" HDD	24
46W0980	1.2TB 10,000 rpm 6Gb SAS 2.5" HDD	24
2.5" SAS HS SSDs		
49Y6072	200GB 6Gb SAS 2.5" SSD	24
49Y6077	400GB 6Gb SAS 2.5" SSD	24

External disk storage systems

The following table lists the external storage systems that are supported by the x3650 M4 BD server and can be ordered through the System x sales channel. The server might support other IBM disk systems that are not listed in this table. For more information, see the IBM System Storage Interoperation Center: <http://www.ibm.com/systems/support/storage/ssic>

Table 24. External disk storage systems

Part number	Description
1746A2D	IBM System Storage DS3512 Express Dual Controller Storage System
1746A2S	IBM System Storage DS3512 Express Single Controller Storage System
1746A4D	IBM System Storage DS3524 Express Dual Controller Storage System
1746A4S	IBM System Storage DS3524 Express Single Controller Storage System

For more information, see the list of IBM Redbooks Product Guides in the System Storage category: <http://www.redbooks.ibm.com/portals/systemx?Open&page=pg&cat=externalstorage>

External backup units

The server supports the external backup attachment options that are listed in the following table.

Part number	Description
External backup units*	
36251TY	IBM RDX USB 3.0 Dock with 1TB Cartridge
362532Y	IBM RDX USB 3.0 Dock with 320GB Cartridge
362550Y	IBM RDX USB 3.0 Dock with 500GB Cartridge
3628L5X	IBM Half High LTO Gen 5 External SAS Tape Drive (with US power cord)
3628N5X	IBM Half High LTO Gen 5 External SAS Tape Drive (without power cord)

* The external tape drives listed can be ordered through the IBM System x sales channel. The server might support other IBM tape drives that are not listed in this table. For more information, see the IBM System Storage Interoperation Center.

For more information, see the list of IBM Redbooks Product Guides in the Backup units category: <http://www.redbooks.ibm.com/portals/systemx?Open&page=pg&cat=tape>

Top-of-rack Ethernet switches

The server supports the top-of-rack Ethernet switches from IBM System Networking that are listed in the following table.

Table 26. IBM System Networking - Top-of-rack switches

Part number	Description
IBM System Networking - 1 Gb top-of-rack switches	
0446013	IBM System Networking RackSwitch™ G8000R
7309CFC	IBM System Networking RackSwitch G8000F
7309CD8	IBM System Networking RackSwitch G8000DC
7309G52	IBM System Networking RackSwitch G8052R
730952F	IBM System Networking RackSwitch G8052F
427348E	IBM Ethernet Switch J48E
6630010	Juniper Networks EX2200 24 Port
6630011	Juniper Networks EX2200 24 Port with PoE
6630012	Juniper Networks EX2200 48 Port
6630013	Juniper Networks EX2200 48 Port with PoE
IBM System Networking - 10 Gb top-of-rack switches	
7309DRX	IBM System Networking RackSwitch G8264CS (Rear to Front)
7309DFX	IBM System Networking RackSwitch G8264CS (Front to Rear)
7309BD5	IBM System Networking RackSwitch G8124DC
7309BR6	IBM System Networking RackSwitch G8124ER
7309BF7	IBM System Networking RackSwitch G8124EF
7309G64	IBM System Networking RackSwitch G8264R
730964F	IBM System Networking RackSwitch G8264F
7309CR9	IBM System Networking RackSwitch G8264TR
7309CF9	IBM System Networking RackSwitch G8264TF
0719410	Juniper Networks EX4500 - Front to Back Airflow
0719420	Juniper Networks EX4500 - Back to Front Airflow
IBM System Networking - 40 Gb top-of-rack switches	
8036ARX	IBM System Networking RackSwitch G8316R
8036AFX	IBM System Networking RackSwitch G8316F

For more information, see the list of IBM Redbooks Product Guides in the Top-of-rack switches category:
<http://www.redbooks.ibm.com/portals/systemx?Open&page=pg&cat=tor>

Uninterruptible power supply units

The server supports attachment to the uninterruptible power supply (UPS) units that are listed in the following table.

Table 27. Uninterruptible power supply units

Part number	Description
Rack-mounted UPS	
21303RX	IBM UPS 7500XHV
21304RX	IBM UPS 10000XHV
24195KX	IBM UPS5000
53952AX	IBM 2200VA LCD 2U Rack UPS (100V/120V)
53952KX	IBM 2200VA LCD 2U Rack UPS (230V)
53953AX	IBM 3000VA LCD 3U Rack UPS (100V/120V)
53953JX	IBM 3000VA LCD 3U Rack UPS (200V/208V)
53956AX	IBM 6000VA LCD 4U Rack UPS (200V/208V)
53956KX	IBM 6000VA LCD 4U Rack UPS (230V)
53959KX	IBM 11000VA LCD 5U Rack UPS (200V/208V/230V)

For more information, see the list of IBM Redbooks Product Guides in the Power infrastructure category:
<http://www.redbooks.ibm.com/portals/systemx?Open&page=pg&cat=power>

Power distribution units

The server supports attachments to the power distribution units (PDUs) that are listed in the following table.

Table 28. Power distribution units (part 1)

Part number	Description
Switched and Monitored PDUs	
46M4002	IBM 1U 9 C19/3 C13 Active Energy Manager DPI® PDU
46M4003	IBM 1U 9 C19/3 C13 Active Energy Manager 60A 3 Phase PDU
46M4004	IBM 1U 12 C13 Active Energy Manager DPI PDU
46M4005	IBM 1U 12 C13 Active Energy Manager 60A 3 Phase PDU
46M4167	IBM 1U 9 C19/3 C13 Switched and Monitored 30A 3 Phase PDU
46M4116	IBM 0U 24 C13 Switched and Monitored 30A PDU
46M4119	IBM 0U 24 C13 Switched and Monitored 32A PDU
46M4134	IBM 0U 12 C19/12 C13 Switched and Monitored 50A 3 Phase PDU
46M4137	IBM 0U 12 C19/12 C13 Switched and Monitored 32A 3 Phase PDU
Enterprise PDUs	
71762MX	IBM Ultra Density Enterprise PDU C19 PDU+ (WW)
71762NX	IBM Ultra Density Enterprise PDU C19 PDU (WW)
71763MU	IBM Ultra Density Enterprise PDU C19 3 Phase 60A PDU+ (NA)
71763NU	IBM Ultra Density Enterprise PDU C19 3 Phase 60A PDU (NA)
39M2816	IBM DPI C13 Enterprise PDU without linecord
39Y8923	DPI 60A Three Phase C19 Enterprise PDU with IEC309 3P+G (208 V) fixed power cord
39Y8941	DPI Single Phase C13 Enterprise PDU without power cord
39Y8948	DPI Single Phase C19 Enterprise PDU without power cord
Front-end PDUs	
39Y8934	DPI 32 amp/250 V Front-end PDU with IEC 309 2P+Gnd connector
39Y8935	DPI 63amp/250 V Front-end PDU with IEC 309 2P+Gnd connector
39Y8938	30 amp/125 V Front-end PDU with NEMA L5-30P connector
39Y8939	30 amp/250 V Front-end PDU with NEMA L6-30P connector
39Y8940	60 amp/250 V Front-end PDU with IEC 309 60A 2P+N+Gnd connector

Table 28. Power distribution units (part 2)

Part number	Description
Universal PDUs	
39Y8951	DPI Universal Rack PDU with US LV and HV power cords
39Y8952	DPI Universal Rack PDU with CEE7-VII Europe LC
39Y8953	DPI Universal Rack PDU with Denmark LC
39Y8954	DPI Universal Rack PDU with Israel LC
39Y8955	DPI Universal Rack PDU with Italy LC
39Y8956	DPI Universal Rack PDU with South Africa LC
39Y8957	DPI Universal Rack PDU with UK LC
39Y8958	DPI Universal Rack PDU with AS/NZ LC
39Y8959	DPI Universal Rack PDU with China LC
39Y8962	DPI Universal Rack PDU (Argentina)
39Y8960	DPI Universal Rack PDU (Brazil)
39Y8961	DPI Universal Rack PDU (India)
0U Basic PDUs	
46M4122	IBM 0U 24 C13 16A 3 Phase PDU
46M4125	IBM 0U 24 C13 30A 3 Phase PDU
46M4128	IBM 0U 24 C13 30A PDU
46M4131	IBM 0U 24 C13 32A PDU
46M4140	IBM 0U 12 C19/12 C13 60A 3 Phase PDU
46M4143	IBM 0U 12 C19/12 C13 32A 3 Phase PDU

For more information, see the list of IBM Redbooks Product Guides in the Power infrastructure category:
<http://www.redbooks.ibm.com/portals/systemx?Open&page=pg&cat=power>

Rack cabinets

The server supports the rack cabinets that are listed in the following table.

Table 29. Rack cabinets

Part number	Description
201886X	IBM 11U Office Enablement Kit
93072RX	IBM 25U Standard Rack
93072PX	IBM 25U Static S2 Standard Rack
93634EX	IBM 42U 1100mm Dynamic Expansion Rack
93634PX	IBM 42U 1100mm Dynamic Rack
93604EX	IBM 42U 1200mm Deep Dynamic Expansion Rack
93604PX	IBM 42U 1200mm Deep Dynamic Rack
93614EX	IBM 42U 1200mm Deep Static Expansion Rack
93614PX	IBM 42U 1200mm Deep Static Rack
93084EX	IBM 42U Enterprise Expansion Rack
93084PX	IBM 42U Enterprise Rack
93074RX	IBM 42U Standard Rack
93074XX	IBM 42U Standard Rack Extension
93624EX	IBM 47U 1200mm Deep Static Expansion Rack
93624PX	IBM 47U 1200mm Deep Static Rack
93634DX	IBM PureFlex™ System 42U Expansion Rack
93634CX	IBM PureFlex System 42U Rack

For more information, see the list of IBM Redbooks Product Guides in the Rack cabinets and options category:

<http://www.redbooks.ibm.com/portals/systemx?Open&page=pg&cat=rack>

Rack options

The server supports the rack console switches and monitor kits that are listed in the following table.

Table 30. Rack options

Part number	Feature code	Description
Monitor kits and keyboard trays		
17238BX	A3EK	IBM 1U 18.5" Standard Console
172317X	0051	1U 17in Flat Panel Console Kit
172319X	0052	1U 19in Flat Panel Console Kit
Console switches		
1754D2X	6695	IBM Global 4x2x32 Console Manager (GCM32)
1754D1X	6694	IBM Global 2x2x16 Console Manager (GCM16)
1754A2X	0726	IBM Local 2x16 Console Manager (LCM16)
1754A1X	0725	IBM Local 1x8 Console Manager (LCM8)
Console cables		
43V6147	3757	IBM Single Cable USB Conversion Option (UCO)
39M2895	3756	IBM USB Conversion Option (4 Pack UCO)
46M5383	5341	IBM Virtual Media Conversion Option Gen2 (VCO2)
46M5382	5340	IBM Serial Conversion Option (SCO)

For more information, see the list of IBM Redbooks Product Guides in the Rack cabinets and options category:

<http://www.redbooks.ibm.com/portals/systemx?Open&page=pg&cat=rack>

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Related publications and links

For more information, see these resources:

- US Announcement Letter - IBM System x3650 M4 BD:
<http://ibm.com/common/ssi/cgi-bin/ssialias?infotype=dd&subtype=ca&&htmlfid=897/ENUS114-015>
- IBM System x3650 M4 BD product page:
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- *IBM System x3650 M4 BD Installation and Service Guide*:
<http://ibm.com/support/>
- ServerProven hardware compatibility page for the x3650 M4 BD:
<http://www.ibm.com/systems/info/x86servers/serverproven/compat/us/xseries/5466.html>
- IBM Redbooks Product Guides for IBM System x servers and options:
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